



# **SITING GEOLOGICAL SEQUESTRATION PROJECTS: PUBLIC PERCEPTION, REGULATORY STRUCTURES AND LEGAL CONSIDERATIONS**

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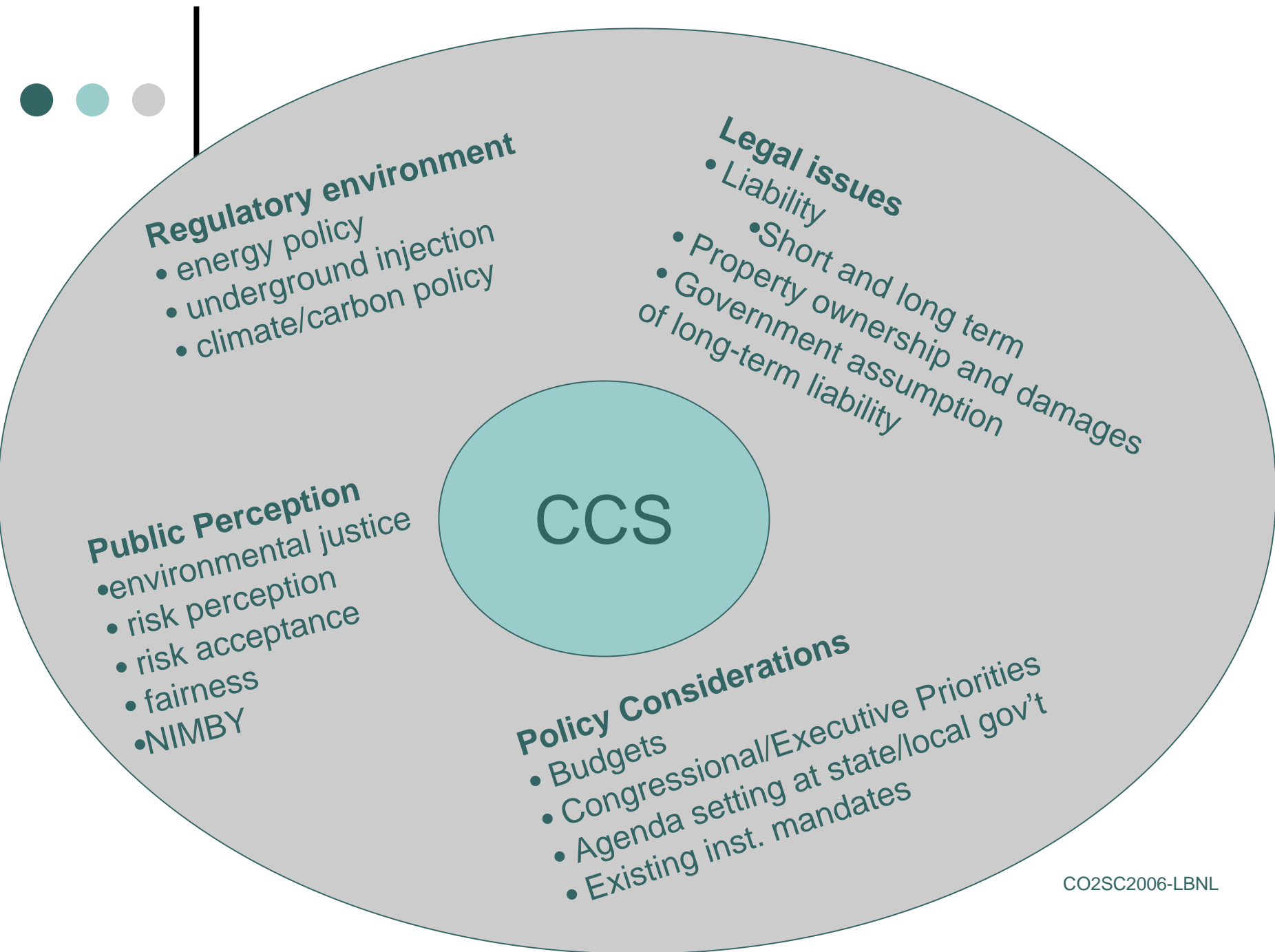
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# Technology embedded

- Site characterization → Siting
- Main points for this talk:
  - CCS will be deployed within a complex regulatory, legal, and political world
  - Technologies have stumbled: GMO's, nuclear energy, stem cell research, biotechnology
  - Work now to focus upon decision-driven risk characterization that addresses questions posed by regulatory, social and legal systems which will all affect project siting





# Talk structure

- Regulatory considerations
- Legal considerations
- Potential social issues
- Risk management and siting research within a public policy context



# Larger Climate and Energy Context

- Climate
  - Caldeira, Jain and Hoffert (2004) estimate that, depending on climate sensitivities, between 75% and 100% of energy will need to be carbon free by 2100 to stabilize the climate at a 2 °C warming
  - Larger (national or international?) accounting and credit system for avoided CO<sub>2</sub> – Fungible credits
  - How can we ensure that injected CO<sub>2</sub> counts?
  - Who gets credit? Who bears liability?
- Energy
  - Rolled out within larger regional energy planning activities
    - Regional differences within natural resources, experience with underground injection
  - Public Utility Commissions
  - At the end of the day, the ratepayer will pay... 100 \$/tC
  - BAU by 2050, using 2x today's coal (2+ billion tons), producing ~5 billion tons of CO<sub>2</sub>



# Regulatory Considerations for Siting

- Protecting public and environmental health
- IEA needs for regulation don't fully match up with current Underground Injection control program
- Siting key for regulation, liability
  - Important component of U.S. Underground Injection Control Program
    - Required analysis
    - Wood casing???
- Geologic sequestration (large volumes, buoyant fluids, long time frames) needs different than BAU injection projects (small quantities, dense fluids, for the most part, no storage time specified)
  - What additional information is needed for current framework to meet regulatory demands?



# Regulatory Considerations for Siting

- How does a regulator think? What do they care about?
- Agenda setting within a regulatory agency
- Difference between current
  - “first generation” EOR-linked projects
    - Regulated to maximize oil or gas extraction
    - Less stringent siting requirements
    - Experienced regulators
    - What happens when EOR becomes sequestration?
  - “second generation” projects within saline aquifers—different legal framework
    - Deep well injection forbidden or non-existent in many states
    - Increasing importance of groundwater for drinking water
    - Institutional capacity varies greatly



# Regulatory Considerations for Siting

- Everything presented at conf. is more extensive than current regulations...
  - Cadillac Seville v. Chevy Chevette
    - What is necessary to adequately site projects? Ensure protection of human and ecological health?
    - How does this differ from current practice?
    - Which mix of technologies gives sufficient information for a particular site?
    - Groundwater protection underlies current regulatory framework
  - What about mixed streams?
    - Role for developing countries
    - Risk profile alteration
  - What types of tests or mechanisms could be developed to help regulators evaluate projects?





# Legal Considerations for Siting

- Considerations of liability, rights, financial risk and damages
- Balance between long term security needs and managing liability for GS projects and short term legal challenges
  - Tort and contract law (trespass, nuisance, strict liability? abnormally dangerous activities)
- Difference between
  - “first generation” EOR-linked projects
    - Hydrocarbon ownership extraction liability regime
    - What happens when EOR becomes sequestration?
  - “second generation” projects within saline aquifers—different legal framework
    - Subsurface rights controlled by surface owner
    - Federal lands attractive....
  - State jurisdictions key



# Legal Considerations for Siting

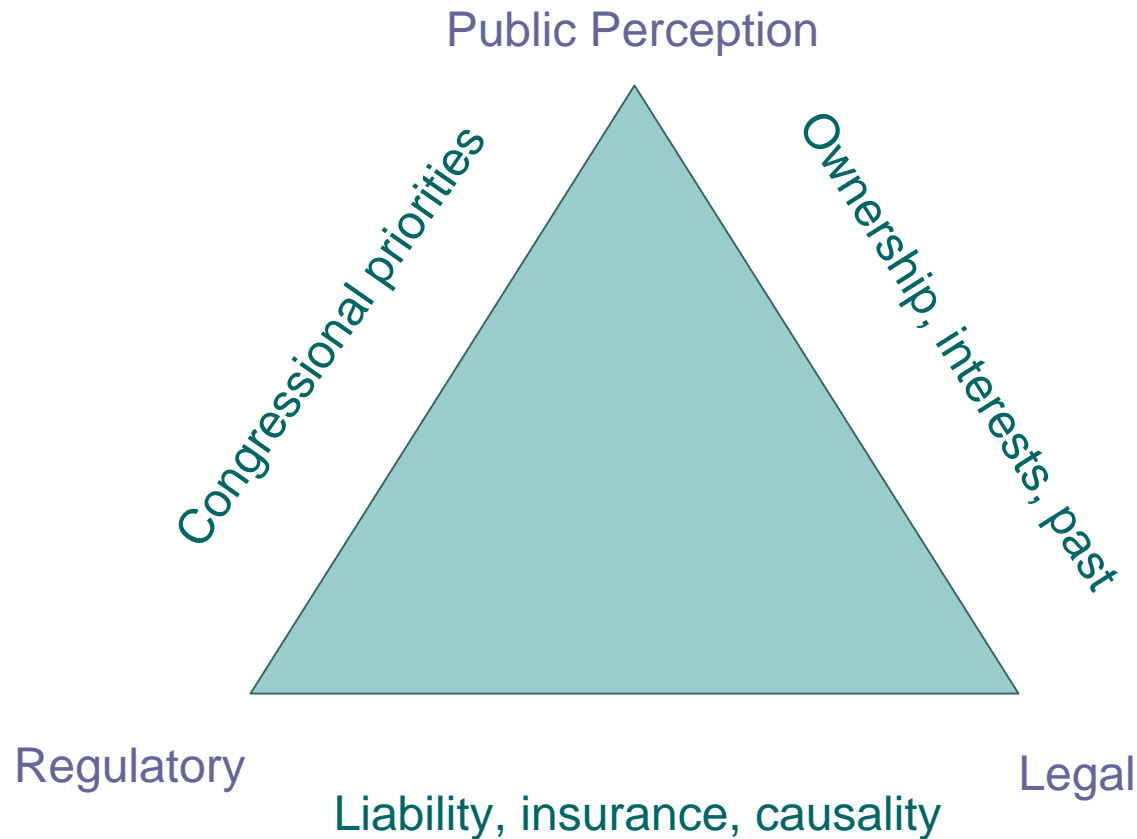
- From a firm perspective, what types of liability are going to drive business decisions? How does this differ across capture, transport and sequestration of CO<sub>2</sub>?
- Large and legal
  - Oil and gas production -- Unitization – making injection efficient, protection from liability
  - Natural gas storage – power of eminent domain
  - GS in saline aquifers...federal lands?
- Liability associated with siting
  - Geophysical trespass
- Implications/affordability of remediation options on liability regime



# Public perception studies on CCS

- Most people don't know about this technology yet
  - Opportunity and risk (ocean sequestration cautionary tale)
  - Concerns: leakage, property values, water
  - NUMBY– “Not Under My Backyard”
  - Location: key in siting,
    - especially important for first few projects
    - Perceived fairness
    - Public involvement in siting/permitting?
  - Characteristics of opposition: Local or national
  - Moral considerations: Future generations

# Interactions between regulatory, legal, and public perception

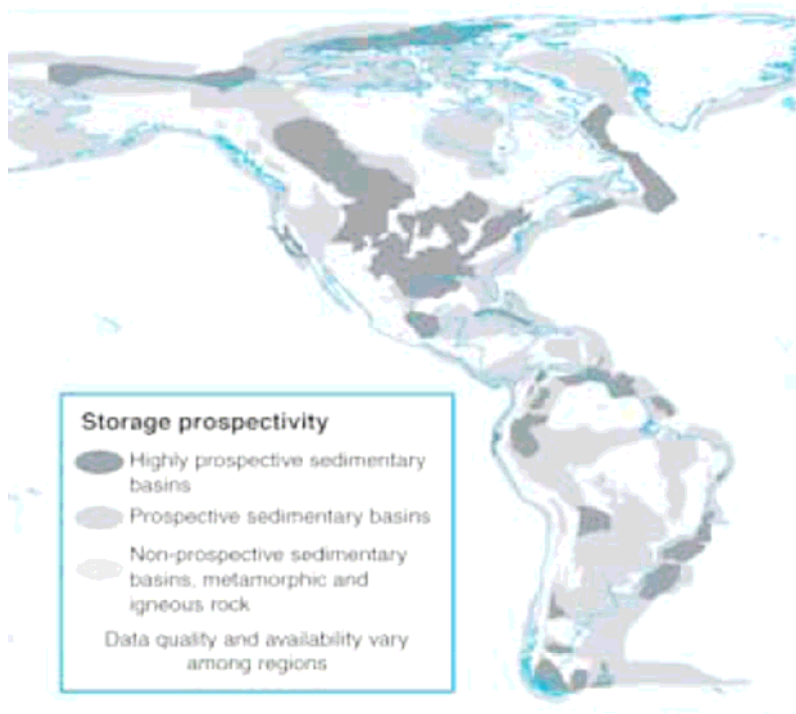




# Geology within a larger context...

- How could this play out politically? What other battles could be fought over CCS siting?
- Future GIS maps also include layers on
  - Population and demographics,
  - Native American Lands,
  - Federal lands
  - National Parks,
  - Endangered Species Habitats,
  - Sole source aquifers,
  - Aquifers for public drinking/agricultural water,
  - Jurisdictions that don't allow deep injection wells
  - Dodgy, undocumented oil and gas production (pre record keeping...)

# One policy consideration for CCS



- CCS, electricity planning and the map...

Source: IPCC SR CCS, 2005



# Decision driven risk characterization

- How can risk characterization (and research) be geared towards deployment?
  - driven by regulatory, legal and public perception demands
  - Leakage, water quality (direct and displacement), remediation
  - What basic tools can be developed? What will become SOP?
  - Iterative nature of activity for new technology
- Different pilot and large scale basin characterization helpful to bound risks and begin to integrate knowledge within institutions
- Better to have science to support decisions than fear...
- Jens' challenge: engage in research that is relevant for developing regulation (and legal , social and political parameters...with goal of deployment)

